

that the Notice of Abandonment had been issued inadvertently, and confirming that a Request for Continuing Examination filed by October 16, 2006 along with a Petition for Five Month Extension of Time would be timely filed. The Examiner also indicated that the Abandonment would be withdrawn. Applicants thank the Examiner for resolving this issue.

Claim Rejections – 35 U.S.C. § 103

In the September 16, 2005 Office Action, the Patent Office rejected pending claims 1-29, 31-64, 66-71 and 85-96 as being obvious under 35 U.S.C. § 103 in view of U.S. Patent No. 6,407,855 B1 (“MacCormack”) and has rejected pending claims 30, 65 and 72-84 as being obvious under 35 U.S.C. § 103 in view of MacCormack further in view of Dianov et al., “Three-cascaded 1407-nm Raman laser based on phosphorus-doped silica fiber”, Optics Letters, Mar. 15, 2000 (“Dianov”). Applicants respectfully request reconsideration.

As an initial matter, Applicants do not concede that MacCormack is properly prior art to the Applicants’ claimed inventions. The Applicants reserve the right to establish an invention date for the claimed inventions that is on or before October 29, 1999, which is the effective §102(e) date of MacCormack apparently relied on by the Patent Office.

As explained below, MacCormack does not teach or suggest all of the limitations of the claimed invention, either alone or in combination with any other reference. In particular, there are significant differences between the claims and MacCormack other than the number of reflectors used in the claimed invention. Furthermore, without conceding that there would have been any motivation to combine MacCormack and Dianov along the lines suggested in the Office Action, even if the proposed combination were made, Dianov still does not cure the deficiencies of MacCormack in rendering any of the rejected claims unpatentable.

a. Rejection of Claims 1-33 under 35 U.S.C. § 103(a)

Claims 2-33 all depend from claim 1. Claims 1-29 and 31-33 were rejected under 35 U.S.C. § 103(a) as being unpatentable over MacCormack. Claim 30 was rejected under 35 U.S.C. § 103(a) over MacCormack in view of Dianov. The Office Action states that MacCormack discloses an optical fiber with all the limitations set forth in these claims, except it does not explicitly teach the

use of more than two pairs of reflectors overlapping in a manner claimed in the instant application. The Office Action further states that the provision of this feature would have been an obvious modification of MacCormack in view of the use of three or more pairs of reflective gratings being allegedly “well known and common in the art”. Applicants respectfully disagree. MacCormack cannot render these claims unpatentable because, *inter alia*, the optical fiber disclosed in MacCormack even as it is proposed to be modified in the Office Action (i.e. by the addition of additional pairs of conventional reflective gratings) still cannot meet all of the claim limitations of independent claim 1. For example, MacCormack does not teach the invention as recited in claim 1 so as to include the limitations expressed in the resonance frequency formula specifically recited in independent claim 1.

MacCormack at Figure 4 and the accompanying description (MacCormack at column 8 lines 42-58) teaches a multiple wavelength source with two overlapping resonator cavities. The pair of gratings 42A and 42B, which are tuned to 1475 nm, forms one of the cavities, and the pair of gratings 44A and 44B, which are tuned to 1485 nm, forms the other of the cavities. The cavities pump gain media 46, 48, and 50. Significantly each resonator cavity of Figure 4 resonates a slightly different wavelength within the *same* Stokes order of the pump energy provided by the pump source indicated at the left hand side of Figure 4. This is made clear throughout the specification. For example, the typical bandwidth within a given Stokes order is roughly 30 nm (e.g., see MacCormack at Column 7, lines 17-23). The pair of gratings 42A and 42B is tuned to 1475 nm, which is only 10 nm different than the wavelength of 1485 nm to which the second pair of gratings 44A and 44B is tuned. This difference is clearly within 30 nm and hence within the same Stokes order. Furthermore, MacCormack elsewhere states that pairs of gratings having tuned wavelengths of 1475 nm and 1485 are in fact both within the same (in this instance, the fifth) Stokes order (see MacCormack at column 57-63). Thus the tuned wavelengths (or frequencies) of the overlapping grating pairs are selected to be within the same Stokes order of the pump energy.

Claim 1, in contrast, requires that each resonance cavity of index M have a resonance frequency c/λ_{sm} , where:

$$\lambda_{sm}^{-1} = \lambda_p^{-1} - \sum_M \lambda_{rm}^{-1}$$

The index numbers are integers. In this formula, (c/λ_{rm}) is a frequency within the gain

spectrum of the Raman active material contained in the gain medium, where c is the speed light. For a resonance cavity having an index with a value N (where N is greater than one), the resonance cavity has a resonance frequency (c/λ_{sn}) and overlaps only with a resonance cavity having a resonance frequency ($c/\lambda_{s(n-1)}$) and with a resonance cavity having a resonance frequency ($c/\lambda_{s(n+1)}$), i.e., the resonance cavities of the immediate prior and immediate subsequent index values. The resonance cavity with the highest index value overlaps only with the resonance cavity of the immediate prior index value.

In other words, as can be verified via simple manipulation of the above formula, the resonance frequency of each cavity of index greater than 1 is a function of at least the resonance frequency of the cavity of immediate lower index. The limitation of this formula does not appear to be taught, suggested or enabled by MacCormack in the combination as recited in claim 1 of the present application; the tuned wavelengths of Figure 4 of MacCormack are selected to be within the roughly 30 nm Raman bandwidth of the same Stokes order of the pump wavelength, and the resonance wavelength of one of the cavities is not a function of the resonance wavelengths of the other of the cavities.

Because each limitation has not been shown by the Patent Office to have been taught or suggested in MacCormack, claim 1 is believed to be patentable over MacCormack for at least the reasons given above. Furthermore, Dianov also does not appear to cure the above discussed deficiencies of MacCormack in disclosing, suggesting or enabling all of the limitations of claim 1. Thus, while the Applicants do not concede that MacCormack teaches the further limitations added by claims 2-33, Applicants note that these claims depend from claim 1 and, thus, are patentable over MacCormack, or MacCormack in view of Dianov, for at least the reasons discussed above with regard to claim 1.

Accordingly, Applicants submit that claim 1 and its dependent claims are not anticipated by or obvious in light of MacCormack, either alone or in combination with any other reference, and request that the rejection be withdrawn.

b. Rejection of Claims 34-68 under 35 U.S.C. § 103(a)

Claims 35-68 all depend from claim 34. Claims 34-64 and 66-68 were rejected under 35 U.S.C. § 103(a) as being unpatentable over MacCormack. Claim 65 was rejected under 35 U.S.C. § 103(a) over MacCormack in view of Dianov. The Office Action states that MacCormack discloses an optical fiber with all the limitations set forth in these claims, except it does not explicitly teach the use of more than two pairs of reflectors overlapping in a manner claimed in the instant application. The Office Action further states that the provision of this feature would have been an obvious modification of MacCormack in view of the use of three or more pairs of reflective gratings being allegedly “well known and common in the art”. Applicants respectfully disagree. MacCormack cannot render these claims unpatentable because, *inter alia*, the optical fiber disclosed in MacCormack even as it is proposed to be modified in the Office Action (i.e. by the addition of additional pairs of conventional reflective gratings) still cannot meet all of the claim limitations of independent claim 34.

Claim 34 has been amended to clarify that the optical fiber must be “substantially devoid of a location that is included in more than two of the resonance cavities.” As shown below, MacCormack, alone or in combination with Dianov, does not appear to disclose, suggest or enable this limitation. Rather, in all of the examples disclosed in MacCormack that contain more than two resonance cavities, there are locations on the optical fiber that are included in more than two of the resonance cavities. For example, Figure 5 of MacCormack shows three gain media (46, 48, 50) and several resonance cavities formed by multiple grating sets. Many points on the fiber depicted in Figure 5 are included in more than two resonance cavities. MacCormack does not teach or suggest an optical fiber as recited in claim 34 that is substantially devoid of a location that is included in more than two of the resonance cavities, nor has the Patent Office pointed to any teaching or suggestion in the prior art to that effect. Applicants thus submit that MacCormack is distinguishable at least on this basis and request that the rejection be withdrawn.

Because each limitation has not been shown by the Patent Office to have been taught or suggested in MacCormack, claim 34 is believed to be patentable over MacCormack for at least the reasons given above. While the Applicants do not concede that MacCormack teaches the further limitations added by claims 35-68, Applicants note that these claims depend from claim 34 and,

thus, are patentable over MacCormack, alone or in view of Dianov, for at least the reasons discussed above with regard to claim 34.

c. Rejection of Claims 69-87 under 35 U.S.C. § 103(a)

Claims 70-87 all depend from claim 69. Claims 69-71 and 85-87 were rejected under 35 U.S.C. § 103(a) as being unpatentable over MacCormack. Claims 72-84 were rejected under 35 U.S.C. § 103(a) over MacCormack in view of Dianov. The basis for the present rejection is essentially the same as that stated above for independent claim 34. As with claim 34, discussed above, claim 69 as amended, and its dependent claims, requires that the optical fiber be substantially devoid of a location that is included in more than two of the resonance cavities. For at least the same reasons as discussed above with respect to claim 34, Applicants submit that MacCormack does not anticipate or render obvious claim 69, and request that the objection be withdrawn.

Because each limitation has not been shown by the Patent Office to have been taught or suggested in MacCormack, claim 69 is believed to be patentable over MacCormack for at least the reasons given above. While the Applicants do not concede that MacCormack nor Dianov teaches the further limitations added by claims 70-87, Applicants note that these claims depend from claim 69 and, thus, are patentable over MacCormack, either alone or in combination with Dianov, for at least the reasons discussed above with regard to claim 69.

d. Rejection of Claims 88-91 under 35 U.S.C. § 103(a)

Claims 88 and 89 are both independent claims. Claim 90 depends from claim 88, and claim 91 depends from claim 89. The last Office Action stated that a ratio of the power of the output wavelength relative to the power of the pump wavelength of at least about 20% of the theoretical limit is inherently met by the operation of the MacCormack device. Thus, the Patent Office appears to be relying on a theory of inherent anticipation with respect to the efficiency limitations of claims 88-91 in its contention that MacCormack renders these claims unpatentable as obvious.

As an initial matter, Applicants point out that the burden is on the Patent Office to establish the inherency in the prior art of each and every one of the claim limitations.¹ The Office Action does not meet this burden because it fails to provide any reasonable rational or technical reasoning to support the proposition that the requirement in claims 88-91 that the ratio of the output power to input power be at least about 20% of a theoretical limit would necessarily flow from MacCormack. Indeed, MacCormack simply indicates that the relative output power at each of the output wavelengths can be controlled by the use of long-period gratings as *loss* elements. Col. 6 Lines 5-24. MacCormack does not indicate that an efficiency of 20% of a theoretical limit (or any other percentage of a theoretical limit) could or would necessarily be achieved by the disclosed structure. Thus, the Patent Office has not, in the present rejection, established an adequate basis in fact and/or technical reasoning to reasonably support the assertion that this limitation recited in claims 88-91 is inherently satisfied by MacCormack, as required under the law (see MPEP § 2112).

Because each limitation has not been shown by the Patent Office to have been taught or suggested in MacCormack, claims 88 and 89 are believed to be patentable over MacCormack for at least this reason. While the Applicants do not concede that MacCormack teaches the further limitations added by claims 90-91, Applicants note that these claims depend from claims 88 and 89 and, thus, are patentable over MacCormack for at least the reasons discussed above with regard to claim 88 and 89.

e. Rejection of Claims 92-94 under 35 U.S.C. § 103(a)

Claim 92 is rejected under 35 U.S.C. § 103(a) as being unpatentable over MacCormack. The Office Action states that MacCormack discloses an optical fiber with all the limitations set forth in the claim, except it does not explicitly teach the use of more than two pairs of reflectors overlapping in a manner claimed in the instant application. The Office Action further states that the

¹ To meet this burden, the Examiner must provide a rationale or evidence tending to show inherency. The fact that a certain characteristic may be present in the prior art is not sufficient to establish the inherency of that result or characteristic (see MPEP §2112). The limitation must necessarily be present in the teachings of the reference, such that it would be recognized as such by persons of ordinary skill in the art (MPEP §2112 and §2131.01). Inherency may not be established by mere probabilities or possibilities (MPEP §2112). “In relying upon a theory of inherency, the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art” (MPEP §2112 quoting Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Int. 1990)(emphasis in original quotation)).

provision of this feature would have been an obvious modification of MacCormack in view of the use of three or more pairs of reflective gratings being allegedly “well known and common in the art”. Applicants respectfully disagree.

Claim 92 requires at least three resonance cavities, each having a different resonance frequency from the others. More specifically, claims 92 requires at least one resonance cavity, which overlaps with only two resonance cavities, where one of the two cavities has a resonance frequency that is one Raman Stokes shift higher than the at least one resonance cavity and the other of the resonance cavities has a resonance frequency that is one Raman Stokes shift lower than that of the at least one cavity. As discussed above with respect to claims 1-33, this configuration is not taught, suggested or enabled by MacCormack.

As noted above in the discussion concerning claim 1, MacCormack at Figure 4 and the accompanying description (MacCormack at column 8 lines 42-58) teaches a multiple wavelength source with two overlapping resonator cavities. However, the pairs of gratings have resonance wavelengths *within the same Stokes order*, which clearly does not meet the express language of claims 92-94. Claims 92-94, in addition to requiring three cavities, expressly recite that one of the cavities have a resonance frequency that is *one Raman Stokes shift higher* than the at least one resonance cavity and the other of the resonance cavities has a resonance frequency that is *one Raman Stokes shift lower* than that of the at least one cavity.

Claims 93 and 94 both depend from claim 1. While the Applicants do not concede that MacCormack teaches the further limitations added by claims 93-94, Applicants note that these claims depend from claim 1 and, thus, are patentable over MacCormack for at least the reasons discussed above with regard to claim 1.

f. Rejection of Claims 95-96 under 35 U.S.C. § 103(a)

Claim 96 depends from claim 95. Claims 95-96 were rejected under 35 U.S.C. § 103(a) as being unpatentable over MacCormack. The basis for the present rejection of independent claim 95 appears to be essentially identical as that articulated for independent claim 1. As with claim 1, claim 95 includes a formula that requires the resonance frequency for each resonance cavity to be based on the sum of the resonance frequencies for the resonance cavities of lower index number.

For at least the reasons discussed above with respect to claim 1, claim 95 is thus also distinguishable over MacCormack. While Applicants do not concede that MacCormack teaches the further limitations added by claim 96, Applicants note that this claim depends from claim 95 and, thus, is patentable over MacCormack for at least the reasons discussed above with regard to claim 95.

Request for Five Month Extension of Time

Applicants hereby request an extension of time of five months to extend the time for taking further action before the PTO subsequent to filing the Notice of Appeal (filed on March 16, 2006) to October 16, 2006.

Electronic Payment of Fees

Fees associated with this filing (Request for Continued Examination of \$395 and Request for Five Month Extension of Time of \$1080 for a Small Entity) are being paid electronically. No other fees are considered to be due. However, if it is determined that an additional fee is due, or that an overpayment has been made, please debit or credit, as appropriate, Deposit Order Account 50-2343.

CONCLUSION

This Response and Amendment addresses all matters raised by the Examiner in the outstanding Office Action. It is respectfully submitted that the case is now in condition for allowance. Please do not hesitate to contact the undersigned if any issues are deemed to remain unresolved.

Dated: October 16, 2006

Respectfully submitted,

By /Peter J. Rainville/
Peter J. Rainville
Registration No.: 41,263
Nufern
7 Airport Park Road
East Granby, CT 06026
860-408-5022
prainville@nufern.com